PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Stereoscopic Motion Pictures.

I, LAURENS HAMMOND, Inventor, of 456, Broome Street, New York City, State of New York, United States of America, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My invention relates to a process of producing stereoscopic effect in motion picture projection, and to apparatus and the disposition thereof for enabling a theatre audience or other like assemblage of people to view motion pictures when projected on a viewing screen with resulting stereoscopic effect.

It is known in methods of obtaining stereoscopic effect in motion picture projection to project in rapid alternate succession, views of the same scene photographed from two slightly different points of view, these views corresponding to the right and left eye views well known in stereoscopic photography. These right and left eye views are projected in these known methods on the screen in rapid alternate succession but they cannot be made to superimpose exactly because they are slightly dissimilar with the result that when the pictures are viewed with the naked eye they appear jumbled and are not clear.

To project these right and left eye pictures one may use as in the known devices and methods either two projecting machines, one machine projecting right eye view pictures only, the other machine projecting the left eye pictures only, such views appearing in alternate succession on the screen, two separate strips of film being used; or one may use one projecting machine only, which machine carries a single strip of film on which right and left eye views of each sceen are arranged in alternate succession.

The improvements according to the present invention over these known methods and apparatus of producing stereoscopic effects in cinema projection are based on the following consideration.

Due to the fact that in the production of stereoscopic effect in picture projection, whether still or motion pictures are used, it is necessary that normal bifocal vision be approximated and the spectator's right eye see a different view of the picture from that seen by the left eye, an individual optical viewing instrument is provided for each spectator through which such spectator may view the projected pictures, which optical viewing instrument is so constructed and electrically synchronized with the picture projection as to obstruct the spectator's view therethrough, so that his right eye sees the right eye projected pictures only and his left eye sees the left eye projected pictures only. To the spectator's view the projected pictures then appear clear and take on the appearance of solidity to which he is accustomed in real life. Viewing instruments assigned to the individual spectators and comprising a motor driven shutter synchronized in some way with the shutter of the projecting machine are also known in the art.

But difficulty with these known viewing instruments has consisted in providing apparatus so controlled that the viewing and projecting mechanism exactly synchronize and in providing individual optical instruments which are capable of starting up inherently from rest and coming almost instantly into exact step with the running optical instruments and the projection apparatus and maintaining such synchronism continuously without any lag on the part of the individual optical instruments so that the desired optical effect results, and in connection with moving pictures, the elimination of the objectionable flicker incident to the use of the process. In the older attempts with moving pictures with which I am

[Price 1/-]

familiar i[illegible] been proposed to project right eye view A, followed by left eye view A and then right eye view B followed by left eye view B and so on throughout the movement series, but due to the speed at which the motion pictures film is shifted to bring the separate photographs in the movement series into position for projection—(for example, sixteen photographs per second)—a shuttering of the right and left eye alternately to obscure the vision so that the right eye sees right eye pictures only and the left eye sees left eye pictures only during their projection on the screen, results in a flicker so objectionable as to render this process undesirable, while on the other hand, if the period of picture projection is determined by the desired frequency of screen darkening to eliminate flicker and at the same time produce stereoscopic effect, it becomes necessary to speed up the film excessively so that each eye sees its view for but an exceedingly small period of time and to increase the film to an excessive length to provide the required number of photographs.

The use of my process and apparatus overcomes all these objections. The process combines the steps of projecting each right eye and left eye picture a number of times in alternation, and of viewing these projected pictures with the help of a novel form of shutter travelling at such speed that in spite of this rapid alternation of the projected pictures the spectator will view each right eye picture projection with his right eye and the left eye projection with his left eye.

Figure 1 is a diagrammatic view of a theatre equipped with apparatus for picture projection.

Figure 2 is an elevation partly broken away of one of the individual optical instruments.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 2.

My process consists in projecting on a screen right and left eye views of each scene in alternate succession a plural number of times. For example, if it is desired to project each photograph three times, the right eye view of picture A would be projected and viewed by the right eye, then the left eye view of A would be projected and viewed by the left eye; then right eye view A would be projected and viewed a second time with the right eye, then left eye view A would be projected and viewed a second time with the left eye, and then right eye view A would be projected and viewed a third time with the right eye and left eye view A would be projected and viewed a third time by the left eye; then the film would be moved to project view B in sequence in a similar manner, each succeeding view in the film being similarly projected and viewed.

In equipping a theatre for stereoscopic picture projection a preferred disposition of apparatus is to provide a variable speed motor 1, which may be situated in the basement, beneath the floor 3 or in some other out-of-the way place in the theatre, and which motor is made to drive, by means of a belt 2, a three-phase, self-exciting alternating current generator 4. The speed of the motor may be varied by means of a field rheostat 5, which rheostat may be conveniently located in the projection booth, which booth is indicated diagrammatically by the line 6. When the speed of the motor 1 is varied, the speed of the alternating current generator 4 is varied in consequence, as is also the frequency of the alternating current which the generator supplies. The field rheostat 16 is connected in the alternator field to keep the alternating current supply at a constant voltage when its frequency is varied. This alternating current passes through a circuit breaker 7 and is led to the three-pole switch 8, which switch may also be conveniently located within the projection booth. When this switch 8 is closed, the current passes on to the step-down transformers 9. The secondary winding of these transformers is connected through fuses 10 to the three wire feeder 11 which runs throughout the theatre and is provided at convenient places in proximity the several seats 12, with suitable electric contacts or connections 13. These connections 13 are here shown as located on the seat arms and are made in the form of three-wire plug sockets into which may be inserted the co-operating electric plugs 14 carried by the individual viewing instruments 15. Connections from the points 22, 23 and 24 lead to the three-pole fuse switch 25, located likewise within the projection booth. When this switch 25 is closed by the operator the motor 26 commences to operate on current supplied from the alternator and under the control thereof. This motor 26 is used to drive projection apparatus or other projection equipment preferably located within the booth, and is a self-starting synchronous motor. A type I prefer to use is an induction squirrel-cage motor having salient magnetic poles which cause the motor to come into synchronous step with the source of alternating current supply, in this case the alternator 4, in one of four certain predetermined positions. This type of motor is well known and will not be further described.

The motor drives a main shaft 27 at a

timed rate of speed, which shaft is shown as driving two well known projectors 28 and 29, which project right and left eye view pictures in alternate succession on a viewing screen 30. The shutter of each machine has three sixty degree blades and the machines are so coupled to the main shaft to be driven therefrom that the shutter of one machine runs sixty degrees in advance of the other, so that one machine will be projecting on the screen while the light from the other machine is obstructed by one of the blades of its flicker shutter.

The intermittent movement which feeds the film through each machine is standard and driven from the main shaft 27. For each complete revolution of the main shaft the Maltese cross which is mounted on the same shaft as the film feed sprocket over which the film travels is rotated a quarter turn and the film is advanced one picture for each quarter turn of such Maltese cross or for each complete revolution of the main shaft. The flicker shutters, one of which is positioned before each machine, are here shown as having three blades. One of the shutters is placed sixty degrees in advance of the other and they are driven from the main shaft a complete revolution for each revolution of the shaft. Therefore, each picture is interrupted three times by the flicker shutter during its projection and due to one machine being driven sixty degrees in advance of the other the periods of picture obstruction of one machine correspond to the periods of picture projection of the other machine, so that the two machines are projecting alternately on substantially the same place on the screen.

Viewing instruments are provided, one for each spectator, and are individually electrically driven and controlled by current supplied through the connections 13 from the alternator.

Briefly described, one of these individual optical instruments 15 comprises a casing 16 provided with a clear-vision portion 17 through which an observer using such instrument may view the screen with both eyes. Mounted within the casing is a rotatable shutter 18 having symmetrically disposed blades which are adapted to alternately shut off the view of one eye of the observer through the portion 17, then the other as the shutter is rotated. This shutter is carried by a spindle which has a bearing for rotation in the rigid hollow shaft which carries the stator of the motor. This spindle also carries a geometrically polarized rotor having relatively large salient poles and which rotor is preferably made of hardened steel. This rotor is positioned externally the [redacted] as shown, with its poles in close proximity to the field winding, leaving a relatively small air gap therebetween.

The essential feature is that a rotating magnetic field be produced about the stator similar to the ordinary rotating magnetic field in an induction motor. It is obvious that this field might be produced in a variety of well known ways with polyphase circuits or with a split phase winding, *etc.* I have selected a two-pole winding so that at any instant there is one north pole and one south magnetic pole on opposite sides of the stator which poles are traveling around the stator at a determined speed depending upon the frequency of the applied current voltage.

With a three-phase twenty-five cycle alternating current voltage, for example, the speed of rotation of the magnetic field is fifteen hundred revolutions per minute.

The wires 11 leading to the field, through which the exciting currents travel, extend through the hollow handle 20, in the shape of a three-wire cable 21. In this type of instrument the current which produces the rotating magnetic field in the motor which drives the shutter emanates from the same source of current supply as that current which energizes the motor which drives the picture projecting apparatus, thereby producing synchronization of both sets of apparatus so that the right eye of the spectator looking through the eye-piece will see right eye projected views and the left eye will see left eye projected views only.

When alternating current voltage is applied to stator winding, a rotating magnetic field is produced which in turn produces a change in flux through the rotor member. The change in flux through the rotor member is retarded by the action of induced eddy currents in the member itself and the material of the rotor is preferably of such a character that the alternating flux will give rise to a magnetic hysteresis loss, which will appear in the form of heat in the substance as long as the alterations are continued. This gives rise to a torque which makes the rotor attempt to follow the revolving magnetic field. The rotor gains in speed continuously until actual synchronism is reached when the rotor member becomes a permanent magnet revolving in exact step with the rotating field.

In the optical instrument it is necessary that a certain angular relationship

be maintained between the shutter and the rotating magnetic field, it not being alone sufficient that the rotor run at synchronous speed but that it should also pull into step in one of two definite positions when the shutter is made with two blades. Either of these two positions of the rotor relative to the revolving field is equally satisfactory for the operation of the instrument as the two blades of the shutter are symmetrically placed. It is evident therefore, that if a four-pole motor were used, a four-blade shutter should also be used. When actual synchronous speed is attained, it will be found, therefore, that the rotor has fallen into step in one of the two definite positions depending upon the polarity of the magnetism in the rotor bar. This is accomplished by the fact that the rotor has two salient poles which always follow the magnetic field in the same relative position.

The instrument is further provided with a handle 20 and a suitable length of flexible cord 21 and is adapted, as described, for detachable connection with the contact positioned on the seat arm, so as to be driven by current from the three-wire feeder 11 and under control of the alternator.

The shutters of all viewing instruments are driven by means of alternating current of one generator, the voltage of which can be varied. The projection equipment for throwing the pictures on the screen is entirely independent of the operation of the individual viewing instrument and none of this equipment need be operated to make the viewing instrument shutters operate. Each individual viewing instrument is so constructed that its interrupting rotating shutter will start up from rest and fall into step in the proper time order with the picture projection so that an observer using the instrument will see with his right eye right-eye projected pictures and with his left eye left-eye projected pictures only. This synchronous relationship will be maintained during the operation of the mechanism and should the rotation of the shutter of the optical instrument be interrupted, due to outside influence such as a shock or jar upon removal of the interfering obstruction the proper time relationship will again almost instantly be regained and the rotation continue. My optical instrument is adapted to operate on standard polyphase alternating current and contains no brushes or sliding contacts and does not require the use of a source of current supply in addition to that provided to drive the projecting apparatus. Each instrument is provided with a self-starting, brushless synchronous motor of novel design, of light weight and capable of operating upon standard polyphase alternating current and which is exceedingly powerful for its mass.

When it is desired to project pictures for stereoscopic viewing, each seat in the theatre being provided with a viewing instrument and the spectators being present, the operator will proceed as follows:

The motor 1 is started, driving the alternator 3. The switch 8 is closed whereupon the shutter 18 in each spectator's viewing instrument 15 begins to operate in synchronism with the supplied alternating current. The picture projection apparatus being ready, the operator closes the switch 25 which starts the motor 26 and consequently the picture projection. The individual viewing instruments and the projecting machines being in synchronism with the alternator 3 it follows that they are in synchronism with each other and that the desired synchronism between picture projection and viewing apparatus is obtained.

To run the main picture projectors faster or slower, the operator varies the resistance through the rheostat 4, slowing down or speeding up the motor 1 and the alternator 3. The viewing instruments 15, motor 26 and all speeds remain in proportion, the performance continuing without interruption. Should an individual viewing instrument be broken or fail to operate, an usher will replace it by disconnecting it at the plug and supplying the spectator with another instrument which, when similarly connected, will immediately pick up the step and begin to operate in synchronism with the running apparatus, the performance continuing while this is being accomplished.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Method of producing stereoscopic effects in optically projected motion pictures in which left and right eye views of the same pictures are projected alternately on the screen and are viewed by a spectator by means of an individual viewing apparatus in which a shutter interrupts in corresponding synchronic alternation the light path for each eye so that all right eye views are only viewed with the right eye and all left eye views with the left eye only, the right

and left eye views of the same picture being projected repeatedly on the screen.

2. A method, as set forth in Claim 1, including the step of providing the motor for driving the projecting mechanism and the individual motors for actuating the shutters of the various viewing devices with current from a common source.

3. A device for producing stereoscopic effects in the projection of motion pictures according to the method as set forth in Claims 1 and 2, including film feeding mechanism, viewing instruments individual to the various spectators and having individual motors for driving shutters arranged in said viewing instruments, a generator for electric current feeding the motor of the film feeding mechanism and the individual motors of the viewing instruments and a control mechanism for said generator to vary the rotary speed of the generator projecting device and the device for actuating the individual shutters of the various viewing mechanism operating at a speed dependent upon the frequency of the current of the generator.

4. A device for producing stereoscopic effects in the projection of motion pictures, as set forth in Claim 3, including in each viewing instrument a shutter disc and a magnetic metallic rotor, said instrument having a rotary field with which said shutter disc is coupled and said rotary field receiving its energization from the current of the generator.

5. A device for producing stereoscopic effects in the projection of motion pictures, as set forth in Claims 3 and 4, including the shutter disc of the viewing instrument, wings corresponding in number to the number of the poles of the rotary field produced in the motor of the viewing mechanism, the rotary disc of the shutter being directly mounted on the rotor of the viewing instrument motor.

6. A device for producing stereoscopic effects in the projection of motion pictures, as set forth in Claims 3, 4 and 5, including in the viewing instrument an induction motor having a squirrel-cage rotor whereby the mere connection of the motor to the source of current will be sufficient to start said rotor and whereby furthermore the synchronous condition with the generator is attained after very short time

7. A method of producing stereoscopic effects in the projection of motion pictures, substantially as described and for the purpose set forth.

8. A mechanism for producing stereoscopic effects in the projection of motion pictures, substantially as described and shown, and for the purpose set forth.

Dated this 25th day of September, 1922.

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Fig. 2

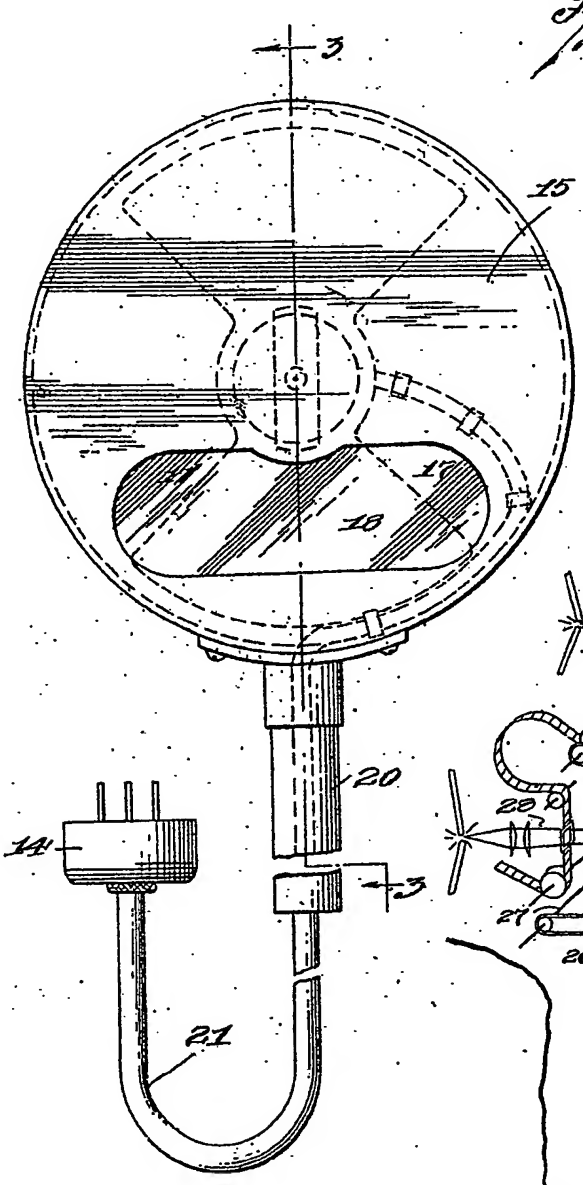


Fig. 1

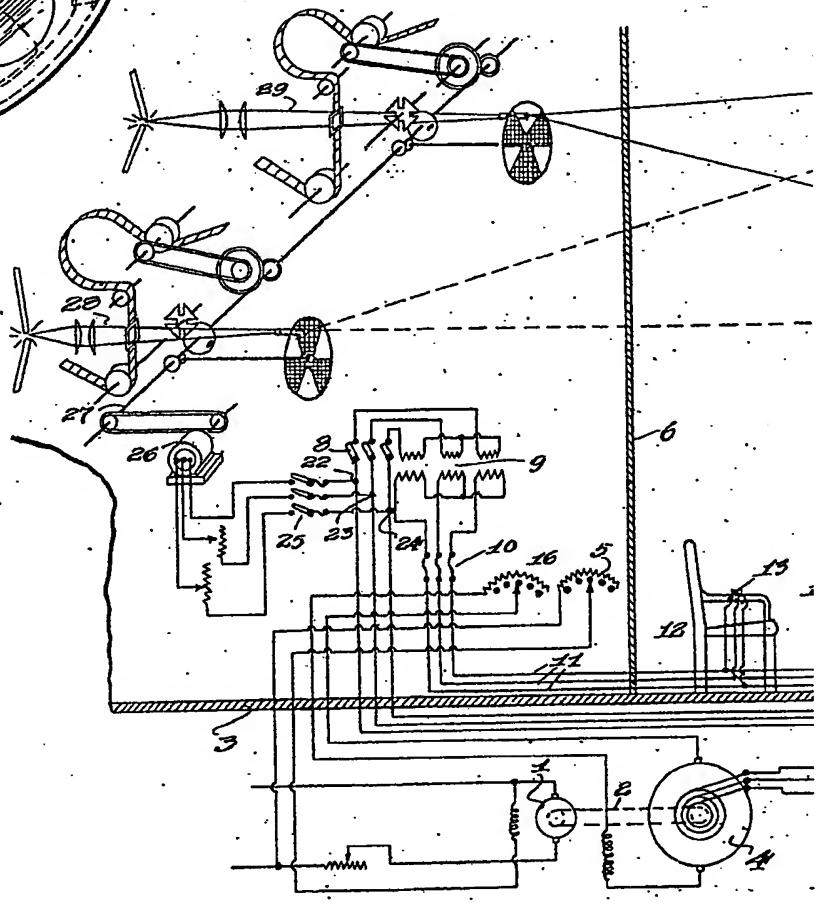
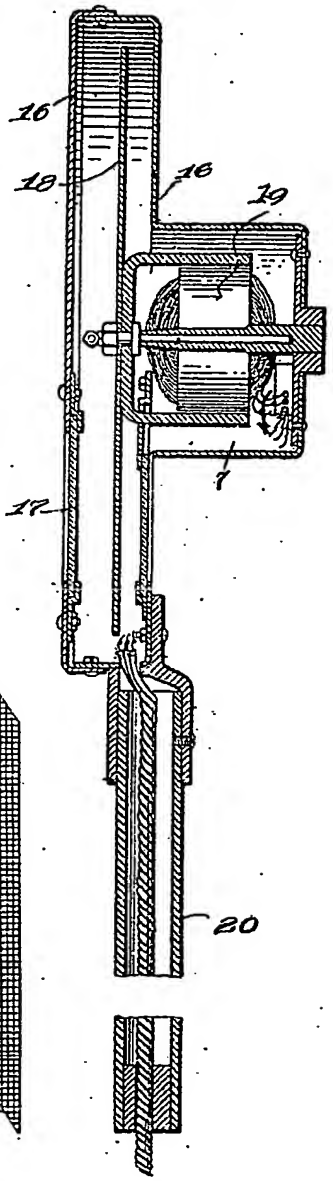


Fig. 3



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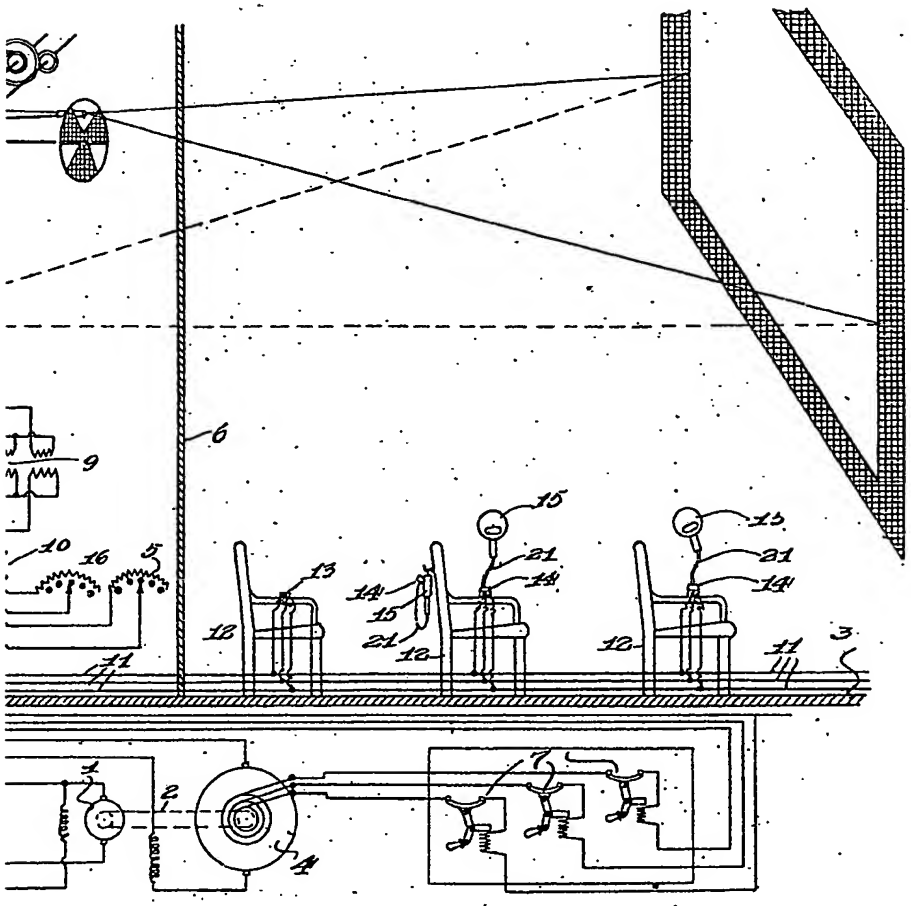

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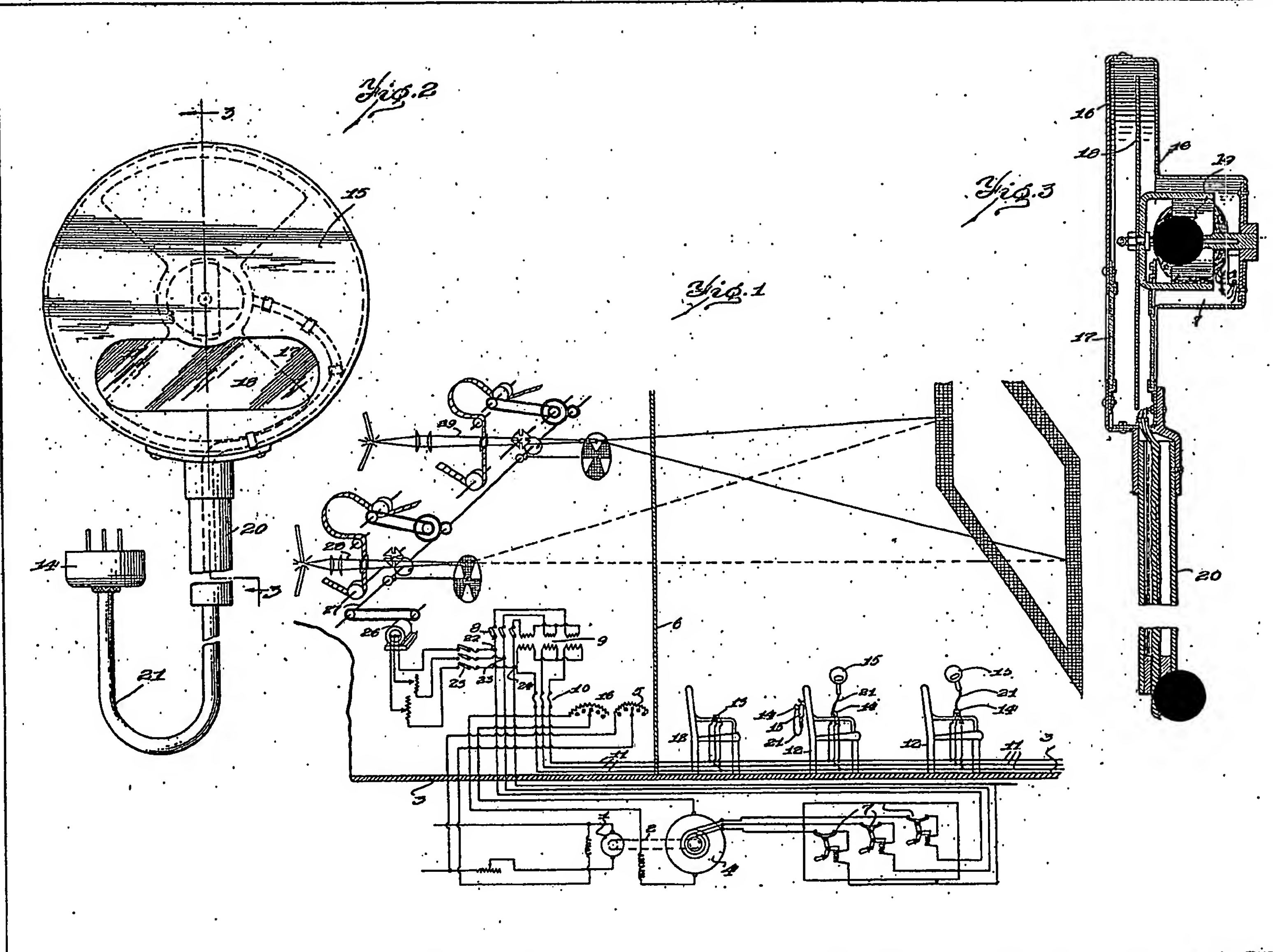

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